Cardiovascular Imaging (Radiology, Ultrasound, Nuclear Medicine, CT, MRI)

GW25-e1058

The Database Establishment of Fetal Congenital Heart Malformation and the Preliminary Investigation of its Clinical Application

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Objectives: To build the database of anatomical ultra-thin cross-section images of the fatal hearts with different congenital heart disease (CHD) and investigate its clinical application preliminarily.
Methods: 40 cases of fetal heart samples induced labor with different kinds of CHD in the second trimester were cut transversely with 60 μm layer thickness. Every section was macroshot to build the database of anatomical ultra-thin cross-section images.
Results: Images in the databases displayed fetal heart structures clearly. After importing them into the three-dimensional (3D) software, the following functions can be realized: (1) Based on the original database of transverse section, the database of sagittal and coronal section can be rebuilt. (2) Original and rebuilt database can be displayed continuously and dynamicly, and rotated in arbitrary angle. They also can be displayed synchronically. The functions above make the database reappear sections and 3D anatomy characteristics of different kinds of fetal CHD and virtualize fetal echocardiography (FECG).
Conclusions: 40 cases cross-section databases of different kinds of fetal CHD were established. The database library of fetal CHD can also be established by accumulating cases, in which sonographers and students can grasp the anatomical features of fetal CHD and virtualize FECG via centralized training or distance education.

GW25-e2496

In Vivo Detection of Macrophages and Observing the Effect of Atorvastatin on Vulnerable Atherosclerotic Plaque using USPIO-enhanced Magnetic Resonance Imaging in Rabbits

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Objectives: The challenge for imaging methods which are non-invasive is to enable identification of the vulnerable plaque (VP) before the occurrence of cardiovascular and cerebrovascular complications. The aims of this study were to determine if ultrasmall super paramagnetic iron oxide (USPIO) can identify VP and if atorvastatin can inhibit VP progression enhanceing the stability of atherosclerotic plaques. Meanwhile we will analysis the role of Matrix metalloproteinase-9 (MMP-9), soluble CD40 ligand (sCD40) that closely relate with vulnerable atherosclerotic plaques.
Methods: Rabbits VP model were successfully built through a hyper cholesterolemic diet combine with adenovirus-carrying p53 injecting into the aortic segments. Magnetic resonance imaging (MRI) sequences and USPIO-enhanced MRI in the rabbits were obtained. At the first day and before sacrifice, the serum was collected for measuring up MMP-9, sCD40 and many other serum indictors. The expression of MMP-9 and sCD40L were respectively determined by enzyme-linked immunoadsorbent assay (ELISA).
Results: VP appeared as areas of hyper-intensity on USPIO-enhanced MRI, especially T2*-weighted sequences, with signal strength peaking at 96 hours.MMp-9 and sCD40L levels in group B were significantly higher than those in groups A and C ($P<0.05$). It was significantly lowest in group C compared with another two groups ($P<0.05$)
Conclusions: Based on the successful establishments of the atherosclerotic plaque models, USPIO-enhanced MRI and pathological markers that are effectively predictive of plaque ruptures. Serum MMP-9 and sCD40L shows close relationships to plaques stability. They release is probably due to the active inflammatory process. Atorvastatin reduces the inflammatory responsing and stabilizing vulnerable plaques and also decreasing the concentration of MMP-9 and sCD40L. Perhaps, the high concentration of serum indictors can forecast the unstability of atherosclerotic plaques.

GW25-e0295

Gender differences in types and frequency of coronary artery anomalies in 10457 Chinese adults detected by 320-slice computed tomography

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Objectives: Although most coronary artery anomalies (CAAs) are thought to be benign, some of them can cause sudden death, syncope, severe arrhythmia, myocardial infarction and heart failure. In addition, CAAs are major challenges during conventional angiography, since they might increase the fluoroscopy time, catheters used and complications during the procedure. The study aimed to investigate the gender differences in types and frequency of coronary artery anomalies (CAAs) in Chinese adults who underwent 320-slice coronary computed tomography.
Methods: The author assessed retrospectively the records of 10, 457 consecutive patients (5837 males and 4620 females) who underwent 320-slice coronary computed tomography for any reason. CAAs were divided into 4 subgroups: (1) Anomalies of origination; (2) Anomalies of intrinsic coronary arterial anatomy; (3) Anomalies of termination (fistula); (4) Number anomalies. Types and frequency of CAAs were calculated and compared between the males and females.
Results: The incidence of CAAs was 35.75% (3738 of 10457, including 2165 males and 1573 females) in total, including 64 (0.62%) subjects with anomalous origin of coronary artery, 3646 (34.87%) individuals with anomalies of intrinsic coronary arterial anatomy (3466 with myocardial bridge, 129 with coronary hypoplasia, 43 with aneurysm, 7 with intercoronary communication, and 1 with atresia), 24 (0.23%) cases with fistula, and 4 (0.04%) patients with number anomalies. No gender differences were presented in most of CAAs in Chinese adults ($P>0.05$), except myocardial bridge ($P<0.01$) and anomaly of LCX originating from the right sinus of Valsalva (sV) ($P=0.027$), which occur more frequently in the males than females.
Conclusions: 320-slice computed tomography is a non-invasive technique to provide important information for accurate diagnosis of CAAs and planning patient management. The present study indicates that no gender differences were showed in most of CAAs in Chinese adults, except myocardial bridge and anomaly of LCX originating from the right sV, which occur more frequently in the males than the females.

GW25-e1431

The myocardial systolic and diastolic function assessment of patients with coronary slow flow phenomenon by quantitative tissue Doppler and two-dimensional speckle tracking imaging

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Objectives: To analyze the myocardial systolic and diastolic function of patients with coronary slow flow phenomenon by quantitative tissue Doppler and two-dimensional speckle tracking imaging.
Methods: This study consecutively enrolled 124 patients with coronary slow flow phenomenon (CSFP) and 134 control subjects with angiographically normal coronary flow detected by coronary angiography from March 2008 to September 2013. Fifty-seven patients amount them were enrolled in imaging processing and analyzing by using the quantitative tissue velocity imaging (QTVI), Tei index and two-dimensional speckle tracking imaging to find out the systolic and diastolic dysfunction in CSFP group and control group. Comparison of continuous variables between the two groups was performed using independent-samples t test respectively.
Results: The Sa peak, mSa, Ea peak, and mEa of QTVI wave in six loci of mitral annuals were similar in CSFP group and control group. The Aa peak and mAa were higher in CSFP group ($P<0.05$), and the Ea/Aa and mEa/mAa in CSFP group were partly lower compared with control group ($P<0.05$). The mitral valve flow spectrum peak E ratio the Ea peak of lateral wall, posterior wall, and Anterior interventricular septal and E/mEa were significantly higher in CSFP group ($P<0.05$). The isovolumic contraction time (IVCT), isovolumic relaxation time (IVRT) and Tei index were higher in CSFP group ($P<0.05$). The S, E, A peaks of QTVI wave in 18 segments of left ventricle wall were no significant difference, and E/A were lower in basal segment of lateral wall and anterior wall ($P<0.05$). The strain, mSRe peak and mSRa peak of strain rate wave were similar in two groups. The mSRs peak of strain rate wave was lower in basal segment of lateral wall and posterior wall in CSFP group ($P<0.05$). The mSRe/mSRa in basal segment of lateral wall and apical segment of inferior wall were lower in CSFP group ($P<0.05$). There were no significant differences in the longitudinal displacement between two groups, while the transversal displacement in middle segment of posterior interventricular septum, basal segment of lateral wall and basal segment of anterior wall in CSFP were higher than control group ($P<0.05$).
Conclusions: The combination of QTVI technology and 2D speckle tracking imaging could prompt that the left ventricular diastolic and systolic dysfunction were exist simultaneously in CSFP patients, and the combination was helpful to build a more comprehensive assessment of cardiac function, to certify the existence of microcirculation dysfunction in patients with CSFP.

GW25-e1574

Two/three-dimensional echocardiography in the assessment of long-term prognosis in patients with pulmonary arterial hypertension

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Objectives: This study was to investigate the relationship between cardiac diastolic dysfunction and outcomes in patients with pulmonary arterial hypertension (PAH). Furthermore, this study would clarify the potential effect of three-dimensional echocardiography (3D-echo) on prognostic value in patients with PAH.
Methods: Patients, which were confirmed by right heart catheterization and diagnosed of WSPH classification I/IV, were received targeted medication (monotherapy or combination medication). Follow-ups were given to all patients every 6 months. 2D/3D-echo parameters, NYHA functional classification, Borg dyspnea score and 6 minute walking distance (6MWD) were recorded. The clinical prognosis of patients

was assessed by the correlation between echo parameters and clinical 6MWD and ROC analysis.
Results: 58 patients with RHC measured SPAP 73.0±23.6mm Hg, DPAP 39.0±13.0mm Hg, MPAP 51.7±15.4mm Hg, PVR 11.6±5.3wood units and CO 4.0±1.3L/min, were given targeted therapies as bosentan (n=18), ambrisentan (n=7), sildenafil (n=13), vardenafil (n=17), tadalafil (n=9), beraprost (n=12) and iloprost (n=1). 17 patients died and 1 performed lung transplantation during the total duration of 30.24±18.46 months' (range 6 to 70 months) follow-up. The left/right ventricular diastolic dysfunction (LVDD/RVDD) score measured by 2D-echo had a good correlation with 6MWD at baseline (r_{LVDD}=-0.699, P<0.001; r_{RVDD}=-0.818, P<0.001) and 6MWD at last follow-up (r_{LVDD}=-0.701, P<0.001; r_{RVDD}=-0.666, P<0.001). Furthermore, bi-ventricular scores (LVDD score + RVDD score) measured by 2D-echo had a better correlation with 6MWD at baseline and last follow-up (r=-0.831, P<0.001; r=-0.771, P<0.001). The correlation between right ventricular parameters (RVEDV, RVESV, RVSV and RVEF) measured by 3D-echo and 6MWD had a statistical significance in the last follow-up (r=-0.556, P<0.001; r=-0.756, P<0.001; r=-0.549, P<0.001; r=-0.847, P<0.001). Receiver operating characteristic (ROC) curve showed that the area under curve (AUC) of LVDD score, RVDD score and (LVDD + RVDD) score were 0.823 (P<0.0001), 0.737 (P=0.0002), and 0.825 (P<0.0001) respectively. Compared with ROC analysis of other single parameters, cardiac diastolic function score was more accurate to predict survival of patients with PAH.
Conclusions: Single ventricular diastolic function score was superior to single parameter measured by 2D-echo to predict clinical prognosis in patients with PAH. And the bi-ventricular diastolic function score was better than single ventricular diastolic function score to predict clinical outcomes in patients with PAH. Contrast to routine echo parameters such as TAPSE, Tei, FAC, 3D-echo was superior to 2D-echo to evaluate right ventricular function. Cardiac diastolic function score was more accurate to predict survival of patients with PAH.

GW25-e1624

Delayed-enhancement MRI using low-dose contrast for the assessment of myocardial infarction

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Objectives: A recent multicenter study shows delayed-enhanced magnetic resonance imaging (DE-MRI) using contrast doses of ≥0.2 mmol/kg is effective in the assessment of myocardial infarction (MI), and 0.1 mmol/kg is not enough; intermediate doses between 0.1 and 0.2 mmol/kg have not been tested. The aim of this study was to prospectively test the performance of DE-MRI using 0.15 mmol/kg of contrast agent for the detection of MI.
Methods: A total of 27 consecutive patients with chronic MI underwent DE-MRI using both 0.15 mmol/kg and 0.2 mmol/kg of contrast agent in random order and on separate days. Infarction segment and infarction size were compared on DE-MRI images using a 17-segment model. Bland-Altman analysis was used to analyze correlation and agreement between global infarct size.
Results: DE-MRI showed enhanced myocardium in all the 27 patients with chronic MI. There was no significant difference between the 0.15 mmol/kg and 0.2 mmol/kg images in all 27 patients based on the infarction segment (7.88±2.75 vs 7.83±2.55, respectively; P>0.05). There was no significant difference between the infarction size obtained from 0.15 mmol/kg acquisition and that from 0.2 mmol/kg acquisition (16.2%±7.7% vs 16.3%±7.8%, respectively; P>0.05). A strong correlation between the infarction size obtained from 0.15 mmol/kg acquisition and that from 0.2 mmol/kg acquisition was indicated through Bland-Altman analysis.
Conclusions: DE-MRI using 0.15 mmol/kg of contrast agent is effective for the assessment of MI.

GW25-e2157

Evaluation of fetal cardiac structure and function of gestational diabetes mellitus by Echocardiography

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Objectives: To investigate the influence of gestational diabetes mellitus (GDM) on fetal cardiac structure and function.
Methods: 96 pregnancies of well controlled GDM with 71 pregnancies with diet control and 25 pregnancies with insulin treatment and the same period 176 normal pregnancies were studied. All the fetuses were divided into 2 groups: <28, ≥28 weeks. The inner diameters of atrioventricular cavity, ventricular cavity, aorta and pulmonary artery were measured by two-dimensional ultrasound. The peak blood flow velocity of each valve orifice were measured by pulse doppler waveforms. M mode was obtained with afterprocessing of STIC. The thickness of ventricular wall and interventricular septal were measured with M mode. The end of systolic and diastolic ventricular volume were measured with afterprocessing of STIC. The left and right ventricular SV, EF and CO were calculated. The early diastolic velocity (Ea) and late diastolic velocity (Aa) of mitral annulus and tricuspid annulus were obtained by TDI.In the meantime, isovolumic contraction time (ICT), isovolumic relaxation time (IRT) together with ejection time (ET) were also acquired. The index of left and right ventricular Tei were calculated. The fetal cardiac function of GDM and normal pregnancy were compared.
Results: There was no statistics difference on all the parameters before 28th week of pregnancy. After 28th weeks of pregnancy, there was a significant increase in ventricular walls and interventricular septal thickness in GDM with insulin treatment compared with normal pregnancies. After 28th weeks of pregnancy, Ea/Aa of tricuspid annulus were smaller in GDM with insulin treatment than that of diet control. There was no difference of other parameters in GDM group with that of normal group.
Conclusions: Gestational diabetes mellitus affect fetal heart mainly in the third pregnancy. After 28th weeks of pregnancy, there was a significant increase in ventricular walls and interventricular septal thickness in GDM with insulin treatment compared with normal pregnancies. The diastolic function is mainly impaired. The diastolic function of right ventricle was lower in GDM with insulin treatment compared with pregnancies with diet control.

GW25-e2470

Increased longitudinal contractility and diastolic function at rest in well-trained amateur Marathon runners: a speckle tracking echocardiography study

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Objectives: Regular physical activity reduces cardiovascular risk. There is concern that Marathon running might acutely damage the heart. It is unknown to what extent intensive physical endurance activity influences the cardiac mechanics at resting condition.
Methods: 84 amateur marathon runners (43 women and 41 men) from Berlin-Brandenburg area who had completed at least one marathon previously underwent clinical examination and echocardiography at least 10 days before the Berlin Marathon at rest. Standard transthoracic echocardiography and 2D strain and strain rate analysis were performed. The 2D Strain and strain rate values were compared to previous published data of healthy untrained individuals.
Results: The average global longitudinal peak systolic strain of the left ventricle was 23%±2% with peak systolic strain rate 1.39±0.21/s, early diastolic strain rate 2.0±0.40/s and late diastolic strain rate 1.21±0.31/s. These values are significantly higher compared to the previous published values of normal age-adjusted individuals. In addition, no age-related decline of longitudinal contractility in well-trained athletes was observed.
Conclusions: There is increased overall longitudinal myocardial contractility at rest in experienced endurance athletes compared to the published normal values in the literature indicating a preserved and even supra-normal contractility in the athletes. There is no age dependent decline of the longitudinal 2D Strain values. This underlines the beneficial effects of regular physical exercise even in advanced age.

GW25-e3388

Three-Dimensional Rotation, Twist and Torsion Analyses by Real-time 3-D Speckle Tracking Imaging: Feasibility, Reproducibility, and Normal Ranges in Pediatric Population

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Objectives: The aims of this study were to evaluate the feasibility and reproducibility of LV rotation, twist and torsion by real-time 3D speckle-tracking echocardiography (STE) in children and to establish their normal values.
Methods: A prospective study was conducted in 347 consecutive healthy subjects (181 male/156 female, and range from birth to 18 years) using RT 3-D echocardiography (3DE). The LV rotation, twist and torsion measurements were made off-line using new TomTec software. Manual landmark selection and endocardial border editing were performed in 3 planes (apical 2-, 4-, and '3-' chamber views) and semi-automated border identification and tracking yielded LV rotation, twist and torsion measurements.
Results: LV rotation, twist and torsion analysis by RT 3D-STI was feasible in 307 of 347 subjects (88.5%). There is no correlation between rotational or twist and age, height, weight, BSA or HR, respectively, using canonical correlation analysis. However, there is a negative correlation between age and LV torsion (P< 0.001). The normal ranges were defined in this cohort for rotation and twist, and for each age group for torsion. The intraobserver and interobserver variabilities for apical and basal rotation, twist and torsion ranged from 7.3%±3.8% to 12.3%±8.8% and from 8.8%±4.6% to 15.7%±10.1%, respectively. Interclass correlation coefficients ranged from 0.78 to 0.89 and from 0.76 to 0.83 for intraobserver and interobserver measurements for rotation, twist and torsion, respectively.
Conclusions: Analyses of LV rotation, twist and torsion by this new RT3D STI methodology are feasible and reproducible in pediatric population.

GW25-e3473

In vivo quantification of VCAM-1 expression in atherosclerosis model using non-invasive targeted ultrasound imaging

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Objectives: Vascular cell adhesion molecule-1 (VCAM-1) is upregulated in the initiation and progression of atherosclerosis. We hypothesized that contrast-enhanced